

**REPLACED BY
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In the "parallel hybrid" configuration, both the combustion engine and the electric motor are connected to the drive wheels by appropriate transmission mechanisms.

Known hybrid drive assemblies of the type briefly
5 described above are complex, expensive, and bulky, which is why, to the Applicant's knowledge, they have never been marketed for compact, low-cost vehicles, such as scooters.

DISCLOSURE OF INVENTION

10 It is an object of the present invention to provide an extremely straightforward, low-cost, compact hybrid drive assembly, which can also be used in small, low-cost road vehicles, such as scooters, but which also permits selection of a number of operating modes on the basis of
15 different operating requirements or road conditions.

According to the present invention, there is provided a hybrid drive assembly for a vehicle having at least one drive wheel, the drive assembly comprising an internal combustion engine; and a transmission unit
20 interposed between a drive shaft of the internal combustion engine and a propeller shaft connected angularly to the drive wheel, and in turn comprising a clutch having a drive member connected to the drive shaft, and a driven member connected to the propeller
25 shaft; said drive assembly also comprising an electric machine which can be operated instead of or in combination with said internal combustion engine, and being characterized in that said electric machine

comprises a rotor connected angularly and permanently to said driven member of said clutch.

The present invention also relates to a vehicle, in particular a scooter, comprising such a hybrid drive assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

Two preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

10 Figure 1 shows a diagram of a hybrid drive assembly in accordance with a first embodiment of the invention;

Figure 2 shows a diagram of a control system for controlling the Figure 1 drive assembly;

15 Figure 3 shows a partial diagram of an alternative embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in Figure 1 indicates as a whole a hybrid drive assembly for a scooter having a rear drive wheel 2 of axis A.

20 Drive assembly 1 comprises a combustion engine 3 having a drive shaft 4 of axis B parallel to axis A; and a transmission unit 5 interposed between drive shaft 4 and a propeller shaft 6 of axis C, parallel to axes A and B, and connected angularly to the drive wheel 2.

25 More specifically, transmission unit 5 comprises a continuously variable transmission or CVT 7 (hereinafter referred to simply as "CVT 7"), and a centrifugal clutch 8 in series with each other.

CLAIMS

1) A hybrid drive assembly (1) for a vehicle having at least one drive wheel (2), the drive assembly comprising an internal combustion engine (3); and a transmission unit (5) interposed between a drive shaft (4) of the internal combustion engine (3) and a propeller shaft (6) connected angularly to the drive wheel (2), and in turn comprising a clutch (8) having a drive member (20) connected to the drive shaft (4), and a driven member (26) connected to the propeller shaft (6); said drive assembly (1) also comprising an electric machine (32) which can be operated instead of or in combination with said internal combustion engine (3), and being characterized in that said electric machine (32) comprises a rotor (35) connected angularly and permanently to said driven member (26) of said clutch (8).

2) A drive assembly as claimed in Claim 1, characterized in that said transmission unit comprises a CVT (7) having a drive pulley (10) connected angularly to the drive shaft (4) of the internal combustion engine (3), and a driven pulley (11) connectable to the hub (20) of the clutch (8).

3) A drive assembly as claimed in Claim 1 or 2, characterized in that said clutch (8) is a centrifugal clutch; said driven member of said clutch (8) being a bell (26) integral with said propeller shaft (6).

4) A drive assembly as claimed in Claim 3, characterized in that said rotor (35) of said electric machine (32) is coaxial and integral with said bell (26) of said clutch (8).

5 5) A drive assembly as claimed in any one of the foregoing Claims, characterized in that said electric machine (32) is reversible.

6) A drive assembly as claimed in one of the foregoing Claims, characterized by comprising a coupling
10 (51) interposed between said drive shaft (4) and said drive member (20) of said clutch (8).

7) A drive assembly as claimed in Claim 6, characterized in that said coupling (51) is controlled electromagnetically.

15 8) A drive assembly as claimed in Claim 6 or 7, when dependent on one of Claims 2 to 5, characterized in that said coupling (51) is interposed between said driven pulley (11) and said drive member (20) of said clutch (8).

20 9) A drive assembly as claimed in any one of the foregoing Claims, characterized by comprising an electric generator (37) driven by said internal combustion engine (3).

10) A drive assembly as claimed in any one of the
25 foregoing Claims, characterized by comprising a control unit (38) for controlling said internal combustion engine (3) and said electric machine (32), in response to a number of input signals (Sa, Sf, Ss), in a number of

operating modes comprising at least a combustion mode wherein only the internal combustion engine (3) is activated, an electric mode wherein said electric machine (32) operates as a motor and said internal combustion engine (3) is disabled, a parallel hybrid mode wherein said internal combustion engine (3) and said electric machine (32) are both activated and connected to said drive wheel (2), and a series hybrid mode wherein said internal combustion engine is disconnected from said drive wheel (2) and drives said electric generator (37).

11) A drive assembly as claimed in Claim 10, characterized by comprising selecting means (46) for selecting said operating modes of said drive assembly (1); said input signals (Sa, Sf, Ss) comprising at least a number of input signals (Ss) generated by said selecting means (46).

12) A drive assembly as claimed in Claim 10 or 11, characterized in that said input signals (Sa, Sf, Ss) comprise a signal (Sa) indicating the position of an accelerator member (44).

13) A drive assembly as claimed in one of Claims 10 to 12, characterized in that said input signals (Sa, Sf, Ss) comprise a signal indicating actions on a brake control member (45) of the vehicle.

14) A vehicle having at least one drive wheel (2), characterized by comprising a hybrid drive assembly (1) as claimed in any one of the foregoing Claims.

15) A vehicle as claimed in Claim 14,

characterized by being a scooter.